**Toothpick Bridges**

**Problem**

What structural design will make the strongest bridge?

**Materials**

1-2 boxes flat or round toothpicks, white glue, balance, 5 gallon-bucket, strong cord, ¼ inch dowel, water (or sand), bathroom scale

**Procedure**

1. Research bridge designs. Take notes of bracing points and the reinforcements. How is the bridge designed to take into account gravitational, and load forces and materials?
2. Design a bridge which you will make from toothpicks and white glue. The total weight of the finished bridge cannot exceed 40 g. You may build any design as long as the roadbed is flat (in a horizontal plane) and unobstructed to allow a hot wheels car to travel the length. It must be free standing and allow for a 2cm x 30 com board to pass under the bridge while it rests on a flat surface. Allow for adequate drying of the glue. Draw a sketch of the bridge to save for further analysis.
3. To test the bridge’s strength, place two flat-topped tables 25 cm apart. Place your bridge between the tables and set the dowel across the middle of the roadbed. Attach 2 loops of strong cord on the handle of the 5 gallon bucket and place the loops over the 2 ends of the dowel. Pour water (or sand) into the bucket slowly until the bridge produces an audible crack sound. Stop adding weight and weigh the dowel, bucket, and contents on the scale. You may continue adding weight until the bridge breaks completely and then take a second reading.

**Summing Up**

Study the remains of your bridge and mark on your sketch the points where the bridge splintered or broke. Draw arrow to note the direction of forces acting on the bridge during the testing. List ways you could alter the bridge design to make it more structurally sound. Redraw the sketch of your bridge which includes the improvements.

**Teacher’s Notes**

You may want to calculate the weight held by the bridge divided by the mass of the bridge to determine the winner. It worked for me to have the bridges built outside of class and tested all in one day. Some bridges have been known to hold over 90 kg (882 N) and added weights even from the weight room might be needed.